



Plants and microbes require three main soil nutrients for growth and reproduction: nitrogen, phosphorus, and potassium (N-P-K). Plants and microbes can take up these nutrients from fertilizers applied to the soil. Apply fertilizer to a spill site to:

- Enhance microbial populations and biodegradation of spilled substances.
- Stimulate growth of seeds, sprigs, or transplants.
- Increase vegetative cover and vigor of surviving plants.
- Encourage establishment of algae and mosses (primary communities), which will build organic matter in the soil and provide a nutrient base for other plants (McKendrick, unpublished data).

How to Apply

Broadcast fertilizer with a cyclone spreader (or by hand in small areas). The fertilizer either may be left to dissolve in water and percolate into the soil, or may be turned into the soil by tilling (Tactic T-19). Cyclone spreaders are commercially available in different capacities and models that can be pushed, pulled with a vehicle, or carried by one person on foot. Fertilizer may be applied simultaneously with seed (Tactic T-21) and soil amendments (Tactic T-18).

Even distribution of fertilizer may require some practice. One method is to measure and mark off a small area to be fertilized, fill the spreader with the amount of fertilizer appropriate for that area, and move in a grid pattern at a steady pace over the area multiple times until the spreader is empty. Calibrate the spreader before use.

How Often to Apply

Generally, only one application of fertilizer is enough to “jump start” the plants and microbes on a site. If a site shows no response to an application of fertilizer (within two growing seasons), it is possible that other problems need to be addressed (e.g., soil pH level, salt level, phytotoxic levels of soil contaminants).

How Much to Apply

The type of fertilizer to apply will depend on soil nutrient deficiencies. Determine nutrient deficiency by testing the soil on site and comparing it to background soil nutrient levels (Tactic AM-4). The fertilizer application rate will depend on the treatment goals for the site. If the goal is to enhance natural revegetation, the lower rate of the recommended application range is usually preferred, especially if a diverse community of plants is already established or desired. If the goal is to stimulate seeds or transplanted sprigs, a mid- to higher rate of the recommended application range may be appropriate. If the goal is to establish a dense stand of a single species of grass to prevent erosion, the highest rate of the recommended application range is appropriate.

Recommended Soil Nutrient Application Rates

NUTRIENT NEEDED	FERTILIZER TO BUY	NUTRIENT APPLICATION RATE (lb/acre)*		
		Wet Tundra	Moist Tundra	Dry Tundra
Nitrogen (N)	<ul style="list-style-type: none"> Ammonium nitrate Urea 	40 to 120	70 to 180	50 to 160
Phosphorus (P ₂ O ₅)	<ul style="list-style-type: none"> Treble superphosphate 	30 to 160	20 to 130	15 to 130
Potassium (K ₂ O)	<ul style="list-style-type: none"> Potassium chloride Potassium sulfate 	40 to 180	40 to 180	40 to 180

*Nutrient application rate is not the *fertilizer application rate*. To figure out how much fertilizer to use, check the nutrient application rate on the table and divide it by the percent nutrient shown on the fertilizer package. Example: Ammonium nitrate contains 34% nitrogen. For wet tundra, nitrogen should be applied at a rate of 120 lb/acre. $120 / 0.34 = 353$ pounds of ammonium nitrate per acre. (Source: unpublished information from Jay D. McKendrick)

APPLICABILITY

	APPLICABILITY	COMMENTS
SUBSTANCE	All	<ul style="list-style-type: none"> Crude oil and diesel can make the soil hydrophobic (unwetterable) and anaerobic (no air). These conditions must be corrected or overcome for fertilizer to be most beneficial.
TUNDRA TYPE	All	<ul style="list-style-type: none"> Wet tundra can tolerate a heavier application of fertilizer than moist and dry tundra.
SEASON	Spring, summer, and fall	<ul style="list-style-type: none"> Optimum season for fertilizer application is spring.

CONSIDERATIONS AND LIMITATIONS

- Fertilizers will not help vegetation if the spilled substance is present at phytotoxic levels in soils and root mat or if the substance made the soil pH or salinity conditions unsuitable.
- Excessive fertilizer application will burn vegetation and may kill some species.
- Fertilizers high in nitrogen may inhibit nitrogen-fixing, hydrocarbon-metabolizing microbes in soil (McKendrick, 1997a).
- Fertilizers high in phosphorus provide good initial plant establishment, but may decrease vegetation species diversity in the long term (McKendrick, 1997a).
- Use of vehicles on tundra must comply with applicable tundra travel policies (Tactic P-5).
- Arctic scientists have adapted for tundra treatment regimes the fertilizer practices used in temporal-zone horticulture and agriculture. Fertilizer has been used to treat a variety of disturbances and spills (crude oil, diesel, glycol) on wet and moist tundra with acceptable short-term success and variable long-term (crude oil only) success (Deneke et al., 1975; Shaver and Chapin, 1986; Kidd et al., 1997; McKendrick, 1999). Little data exist documenting the benefits of fertilizer use on dry tundra.
- Results of fertilizer use will vary according to tundra type and effects of the substance spilled. An *appropriately* fertilized wet tundra site may reach previous levels of plant cover and diversity up to 50 percent faster than a “no action” site (McKendrick, 1999).

EQUIPMENT, MATERIALS, AND PERSONNEL

- Necessary quantity of appropriate fertilizer
- Cyclone spreader (1 operator) – to broadcast fertilizer
- Vehicle approved for tundra travel (1 operator) – to pull a cyclone spreader over larger sites